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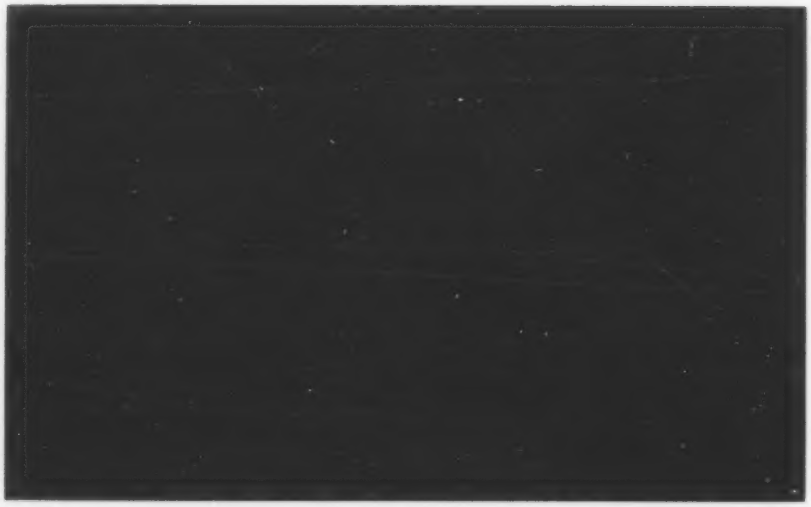

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CRT-831

Risk Factors in Traffic Accident Involving Child Pedestrians*

by

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* This research was supported by a fellowship from the Fonds pour la formation des chercheurs et l'aide à la recherche F.C.A.R./Transport and the Social Sciences and Humanities Research Council of Canada.

Centre de recherche sur les transports — Publication #831

May 1992

Dépôt légal – 2e trimestre 1992

93-01786/

ABSTRACT

This study attempts to determine how child pedestrians involved in traffic accidents differ from uninjured children. Questionnaires were completed by a sample of parents whose children had been injured in traffic accidents and by a sample of parents whose children were at a hospital for reasons others than accidents. The total number of subjects was 84. Forthy-two injured children aged 5 to 14 were matched by sex and age with 42 uninjured children. Both groups came from a single geographic area, which had been previously identified as a high risk area for traffic accidents (Joly, 1985). The Mantel-Haenszel odds-ratio method was used to estimate the relation between different factors and the risk of injury.

Children aged 5 to 9 are most likely to be involved in an accident, and boys have twice as many accidents as girls. Accident risk is two times greater for children crossing at a protected crosswalk, and five times greater for children who do not understand traffic safety rules. Children who have an intense and short playing time in the street after school are three times as likely to be involved in a accident as those who play for longer periods. Going alone to school without supervision by an adult increases risk three fold, while absence of supervision after school increases risk eleven fold. Accident risk is two and one-half times higher for children whose parents have less than 11 years of school.

Keywords: traffic accidents, pedestrian accidents, children accidents, traffic trauma, morbidity.

RÉSUMÉ

Dans un quartier montréalais, précédemment identifié comme étant à haut risque d'accidents de la circulation pour les enfants, des questionnaires ont été passés auprès de 84 familles. La moitié de ces familles avaient un enfant âgé de 5 à 14 ans qui venait d'avoir un accident comme piéton. Chaque enfant a été jumelé avec un autre enfant du même âge et du même sexe qui n'avait pas eu d'accident pendant la même période d'étude – soit 18 mois – d'octobre 1980 à mars 1982. Les parents ont été interrogés sur les comportements de déplacement et les habitudes de vie de leur enfant ainsi que sur le type de circulation du voisinage et différentes données socio-économiques. La méthode du rapport de cote de Mantel-Haenszel a été utilisée pour évaluer les risques relatifs d'accident entre les groupes.

Les principaux résultats montrent que les garçons ont deux fois plus d'accidents que les filles, et que les âges les plus à risque sont de 5 à 9 ans. Les enfants qui ne comprennent pas les règles de la circulation courent un risque 5 fois plus élevé que leurs congénères. Le risque est triplé pour ceux qui vont seuls à l'école et est multiplié par onze pour ceux qui restent dans la rue après l'école sans être surveillés. L'intensité de l'exposition, l'intensité de la circulation ainsi que le niveau socio-économique sont des variables discriminantes du risque d'accident.

Mots-clés: Accidents, piétons, enfants, comportements de déplacement, risques environnementaux.

RISK FACTORS IN TRAFFIC ACCIDENT INVOLVING CHILD PEDESTRIANS

INTRODUCTION

Traffic accidents remain the most serious cause of mortality for children in the industrialized world; among children older than one year, the number of accidents has reached epidemic proportions (WHO, 1980). The risk is particularly great for young pedestrians: one third of pedestrians who are killed or injured in traffic accidents are younger than fiften.

The vast majority of pedestrian accidents take place in cities. Studies have shown that pedestrian accidents involving children are not randomly distributed in urban areas (Read et al., 1963; Injury in America, 1985; Pearn, 1978; Backett and Johnston, 1959; Joly, 1985). While several authors have found a positive correlation between high traffic density and accident rates (Read et al., 1963; Slatis, 1967; Bennett and Marland, 1978), Mölen (1983) found that more children were accident victims on streets where traffic levels were relatively low. The extent to which young pedestrians are protected by controlled crossings with traffic lights is also undetermined (De Vrieze, 1974; Fleig and Duffy, 1967). Several studies have shown that integrating and understanding complex traffic information is a basic problem for children (Blackman, 1969; Sandels, 1974; O.E.C.D., 1983). Most accidents take place on the way to school (Blackman, 1969; Grayson, 1975) or else while children are playing in the street (De Vrieze, 1974; Blackman, 1969). The availability of recreational areas either increase or decrease accident levels (Read et al., 1963; Backett and Johnston, 1959; Bartholomew, 1967). Far more boys than girls are involved in accidents

(Grayson, 1975). According to certain researchers (Biehl et al., 1969; Heimstra et al., 1969), this is due to the greater propensity of boys for risk-taking. However, this conclusion is disputed by Howarth (Howarth et al., 1974). While some studies have shown that children whose mothers work outside the home tend to have more accidents (Backett and Johnston, 1959; Brown et Davidson, 1978), another study has shown just the opposite (Ekstrom et al., 1966). Nevertheless, a general consensus is emerging that lack of supervision increases the risk of accident (O.E.C.D., 1983; Backett et al., 1959; Grayson, 1975).

METHOD

A prospective study was carried out over a period of 18 months to identify children who had been involved in a traffic accident on Montreal Island between october of 1980 and March of 1982. Case retrievals were conducted in the emergency wards of the two main children hospitals and in nine other Montreal Island hospitals (Pless et al., 1987). During the same period, all accidents officially reported by or to the police departments of the study region were examined and compared with the above-mentioned hospital data. It was found that almost 40% of the hospital-identified cases were not included in police accident report files. Characteristics of children accidents revealed by this data were analyzed and have been the topic of previous papers (Joly, 1985; Joly et al., 1990). This study examines individual differences between child pedestrians involved in traffic accidents as compared with uninjured children living in the same neighbourhood.

Questionnaires were completed by a sample of parents of children who had been injured in traffic accidents and by a sample of parents whose children were at a hospital for reasons others than traffic accidents (Pless et al., 1987). Parents were questioned about the density of traffic on the street and in the neighbourhood of the child's home; exposure to traffic: means of transportation to and from school, number of roads crossed daily, whether crossings involved traffic lights or protected cross walks; and the level of the child's understanding of traffic safety rules, as perceived by the parent interviewed. Information concerning the potential activity-space of the child including the street was also obtained and completed by observations in the field, including the presence or absence of backyard playing areas and neighbourhood parks. For children under five, a park was considered available if it was located less than 100 metres from the child's home and was not separated from home by a street with middle density traffic. For children aged 5 to 9, a park was considered part of their potential activity-space if it was located within a radius of 300 metres from home and was not separated from the home by a physical barrier such as a highway, waterway or railroad. For those aged 10 to 14, a park located within a radius of one kilometre from the home was considered a part of the child's potential activity-space. If the child lived in an apartment building, potential activity-space was considered to be generally more restricted than for children in duplexes or single family homes. Level of supervision of the child (being accompanied by an adult to school; having an after-school sitter) was also a variable, as was the family's socio-economic status as determined by the level of education. To take into account effect of pedestrian exposure to traffic, we analyzed children living to a single neighbourhood located in the south-central area of

Montreal Island. In a former study (Joly et al., 1985, 1990) this area was identified as a high risk area for traffic accidents. It is characterized by high population density, poorly maintained dwellings and low family socio-economic status (i.e., high rate of unemployment, low level of education, low income).

The total number of subjects was 84. Forty-two injured children aged 5 to 14 were matched by sex and age with 42 uninjured children. The Mantel-Haenszel odds ratio method, which was used to compare risk factors between cases and controls, is a measure of association which estimates the relative risk (RR) (Mantel-Haenszel, 1959; Schlesselman, 1982). The last column indicates the confidence interval at 95%. There is a positive association between exposure and a given factor if the odd ratio is > 1. There is no association for the data analyzed if the odd-ratio equals 1.

RESULTS

Boys were twice as likely to be involved in a pedestrian accident as girls. With regard to age, 52% of the children injured were between 5 and 9 years of age. Both groups (injured and uninjured) viewed the potential danger of intense traffic in their street and neighbourhood in much the same way: O.R. = 1.20 for high traffic versus low traffic in the residence street and O.R. = 1.36 for high traffic versus low traffic in the neighbourhood. Three-quarters of the two groups go to school on foot; the others travel by car or bus. Our study showed a low association between accident risk and walking to school (O.R. = 1.27) (Table I).

The similarity of life-styles among cases and controls is indicated by a similar number of streets crossed daily by both groups. However, crossing at a protected crosswalk was found to increase accident risk two fold (O.R. = 2.15). One of the major risk factors found was failure to understand safety rules (O.R. = 4.97). Playing on the street after school due to the absence of a backyard (O.R. = 1.33), the inaccessibility of recreational parks (O.R. = 1.61), or living in a high rise (O.R. = 2.31) increased accident risk, as did intense playing in the street for a short time after school (O.R. = 2.91).

In terms of supervision, children going to school alone are three times as likely to be involved in an accident as those accompanied by an adult (O.R. = 2.86). Absence of supervision after school increases accident risk eleven fold (O.R. = 10.80). The children in both case and control groups come from lower socio-economic levels: average level of parental education was below grade-eleven and many parents were on welfare. Accident risk was two and one-half times higher (O.R. = 2.43) for children whose parents had not finished secondary education (less than 11 years of school).

DISCUSSION

The two-to-one predominance of male accident victims observed corresponds to the findings for traffic accidents in general (R.A.A.Q., 1982; R.A.A.Q., 1984; Waller, 1984; Baker et al., 1984).

To control for environmental, cultural, and socio-economic factors, only children living in the designated area were included in the samples of injured and uninjured children (i.e., control by stratification of the sample choice). Montreal, like many other North American cities, shows strong patterns of spatial differentiation - high and low socio-economic areas are clearly defined in urban space, as are cultural and ethnic areas (Foggin and Polèse, 1976; Pampalon, 1980; Loslier, 1976).

Life-style is also clearly defined in different urban areas, particularly for children who go to school within the residential area and whose main activity-space after school is within a short radius of home (O.E.C.D., 1983). Thus it is not surprising that there were no significant differences between groups in number of streets crossed or transportation used for going to school. Both groups also viewed the potential danger of intense traffic in the same way and were equally divised into traffic area-types: one-third lived in slow traffic areas, one-third in medium density traffic areas, and one-third in dense traffic areas.

Crossing at protected crosswalks increases accident risk two fold. This has been observed by other researchers, particularly with elderly pedestrians (Read et al., 1963; Baker et al., 1984). It has been suggested that this results from a high frequency of crossing at such locations that gives rise to a false sense of confidence and security which contributes to a lack of attention. Playing on the street after school due to a lack of playing-space in the house or inaccessibility of a park (or unwillingness to play in a park) increases exposure to risk. Risk is increased during after-school hours (4 to 6 p.m.) because they correspond to peak traffic

volume and children are often fatigued, resulting in increased carelessness. In winter, decreased visibility could be another accident factor.

Playing intensively after school for short times increases risk three fold. This confirms De Vrieze's work (De Vrieze, 1974) and could be explained by the fact that children who play for short times are not as familiar with the dangers of the street as those who play for longer periods. It may also be affected by the phenomenon of compensation; i.e. trying to get the maximum of activity into a short period and so acting impulsively and taking more risk. These hypotheses remain to be confirmed by subsequent research.

Lack of supervision in terms of going to school alone increases the risk of accident by a factor of three. Absence of supervision after school is even more dangerous: risk is eleven times as great. Almost all controls had someone looking after them after school as compared with 63% of cases. These results reflect those found in the literature, but the risk levels observed were higher.

CONCLUSION

Estimating accident risk is not an easy task. We are aware that the analysis given here is limited by factors which are not discussed and by the bias introduced by questionnaires written a posteriori (post-trauma answers). However, our results are, for the most part, consistent with other studies. The findings can serve to remind us that crosswalks are not

as safe as they look and that children need some kind of supervision after school. In particular, it is important to recognize that child pedestrians are at risk and that continual prevention through education, enforcement, and improved enginering is necessary. To be effective, prevention must include different kinds of measures directed toward environmental improvements as well as assistance to individuals.

Table I

Risk of traffic accidents among child pedestrians

Risk factors	Case n=42	Control n=42	O.R.*	C.I.(95%)
Traffic				
High street traffic	52%	47%	1.20	0.52-2.81
Low street traffic	48%	53%		
High neighbourhood traffic	73%	66%	1.36	0.53-3.50
Low neighbourhood traffic	27%	34%		
Exposure				
Walking to school	76%	72%	1.27	0.42-3.84
Going to school by bus or car	24%	28%		
Crossing streets				
High number (>12) of roads crossed daily	36%	33%	1.11	0.45-2.73
Low number (<12) of roads crossed daily	64%	67%		
Crossing at protected crosswalk	91%	82%	2.15	0.47-9.92
Crossing elsewhere	9%	18%		
Traffic rules				
Not understanding traffic safety rules	12%	3%	4.97	0.53-46.89
Understanding traffic safety rules	88%	97%		
The street: place and kind of activity				
Absence of back yard	57%	50%	1.33	0.56-3.15
Presence of back yard	43%	50%		
Inaccessibility of recreational park	55%	43%	1.61	0.68-3.82
Accessibility to a recreational park	45%	57%		
Living in a high rise appartment	24%	12%	2.31	0.72-7.47
Living in a house or duplex	76%	88%		
Intensive play (<1 hr) in the street after school	83%	63%	2.91	1.04-8.21
Longer play (>1 hr) in the street after school	17%	37%		
Supervision				
Going alone to school	66%	41%	2.86	0.67-12.11
Being accompanied to school by an adult	34%	59%		
Absence of sitter after school	37%	5%	10.80	1.13-102.85
Presence of sitter after school	63%	95%		
Socio-economic factors				
Low education (<11 years) of the head of the family	80%	62%	2.43	0.88-6.76
Education of the head of the family > 11 years	20%	38%		

* *The odds ratio here represents the relative risk of the factor mentioned in the upper row in comparison with the factor mentioned in the lower row.*

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